

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:
 - a first converter configured to convert a first
5 digital audio signal sampled with a predetermined audio
sampling frequency for digital audio into a second digital
audio signal sampled with a predetermined voice sampling
frequency for voice signals;
 - a second converter configured to convert a first
10 digital voice signal sampled with the predetermined voice
sampling frequency into a second digital voice signal
sampled with the predetermined audio sampling frequency;
 - a first digital processor configured to perform a
predetermined digital computation on the second digital
15 audio signal sampled with the predetermined voice sampling
frequency and a digital voice signal; and
 - a second digital processor configured to perform the
predetermined digital computation on the second digital
voice signal sampled with the predetermined audio sampling
20 frequency and the first digital audio signal sampled with
the predetermined audio sampling frequency.

2. The semiconductor device according to Claim 1,
wherein the predetermined digital computation includes an

addition, a subtraction, a rate setting of the addition, and
a rate setting of the subtraction.

3. The semiconductor device according to Claim 1,
5 wherein the first digital processor performs a volume
setting on a digital signal processed with the predetermined
digital computation.

4. The semiconductor device according to Claim 1,
10 wherein the first digital processor performs a signal band
limitation on a digital signal processed with the
predetermined digital computation.

5. The semiconductor device according to Claim 4,
15 wherein the signal band limitation is pre-programmable.

6. The semiconductor device according to Claim 1,
wherein the second digital processor performs a volume
setting on a digital signal processed with the predetermined
20 digital computation.

7. The semiconductor device according to Claim 1,
wherein the second digital processor performs a signal band
limitation on a digital signal processed with the

predetermined digital computation.

8. The semiconductor device according to Claim 7,
wherein the signal band limitation is pre-programmable.

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9. A mobile phone using a semiconductor device,
comprising:

an input device configured to convert a voice into an
analog voice signal;

10 a voice analog-to-digital converter configured to
convert the analog voice signal output from said input
device into a first digital voice signal;

a voice digital-to-analog converter configured to
convert a second digital voice signal sampled with a
15 predetermined voice sampling frequency for voice signals
into an analog voice signal;

a voice output device configured to generate a voice
sound in accordance with the analog voice signal output from
said voice digital-to-analog converter;

20 an audio digital-to-analog converter configured to
convert a digital audio signal sampled with a predetermined
audio sampling frequency for audio signals into an analog
audio signal; and

an audio output device configured to generate an audio

sound in accordance with the analog audio signal output from said audio digital-to-analog converter,

wherein the semiconductor device is configured to process the digital voice signal, the digital voice signal
5 sampled with the predetermined voice sampling frequency, and the digital audio signal sampled with the predetermined audio sampling frequency, and comprises:

a first converter configured to convert the digital audio signal into a first converted signal sampled with the
10 predetermined voice sampling frequency;

a second converter configured to convert the digital voice signal into a second converted signal sampled with the predetermined audio sampling frequency;

a first digital processor configured to perform a
15 predetermined digital computation on the digital audio signal sampled with the predetermined voice sampling frequency and the first digital voice signal; and

a second digital processor configured to perform the predetermined digital computation on the second digital
20 voice signal sampled with the predetermined audio sampling frequency and the digital audio signal sampled with the predetermined audio sampling frequency.

10. The mobile phone according to Claim 9, wherein

the predetermined digital computation includes an addition, a subtraction, a rate setting of the addition, and a rate setting of the subtraction.

5 11. The mobile phone according to Claim 9, wherein the first digital processor performs a volume setting on a digital signal processed with the predetermined digital computation.

10 12. The mobile phone according to Claim 9, wherein the first digital processor performs a signal band limitation on a digital signal processed with the predetermined digital computation.

15 13. The mobile phone according to Claim 12, wherein the signal band limitation is pre-programmable.

 14. The mobile phone according to Claim 9, wherein the second digital processor performs a volume setting on a
20 digital signal processed with the predetermined digital computation.

 15. The mobile phone according to Claim 9, wherein the second digital processor performs a signal band

limitation on a digital signal processed with the
predetermined digital computation.

16. The mobile phone according to Claim 15, wherein
5 the signal band limitation is pre-programmable.

17. A mobile phone using a semiconductor device,
comprising:

an input device configured to convert a voice into an
10 analog voice signal;

a voice analog-to-digital converter configured to
convert the analog voice signal output from said input
device into a first digital voice signal;

a digital voice amplifier configured to amplify and
15 output a second digital voice signal sampled with a
predetermined voice sampling frequency for voice signals;

a voice output device configured to generate a voice
sound in accordance with the second digital voice signal
output from said digital voice amplifier;

20 a digital audio amplifier configured to amplify and
output a digital audio signal sampled with a predetermined
audio sampling frequency for an audio signal;

an audio output device configured to generate an audio
sound in accordance with the digital audio signal output

from said digital audio amplifier,

wherein the semiconductor device is configured to process the first digital voice signal, the second digital voice signal sampled with the predetermined voice sampling
5 frequency, and the digital audio signal sampled with the predetermined audio sampling frequency, and comprises:

a first converter configured to convert the digital audio signal into a signal sampled with the predetermined voice sampling frequency;

10 a second converter configured to convert the first digital voice signal into a signal sampled with the predetermined audio sampling frequency;

a first digital processor configured to perform a predetermined digital computation on the digital audio
15 signal sampled with the predetermined voice sampling frequency and the digital voice signal; and

a second digital processor configured to perform the predetermined digital computation on the first digital voice signal sampled with the predetermined audio sampling
20 frequency and the digital audio signal sampled with the predetermined audio sampling frequency.

18. A semiconductor device comprising:

first converting means for converting a first digital

audio signal sampled with a predetermined audio sampling frequency for digital audio into a second digital audio signal sampled with a predetermined voice sampling frequency for voice signals;

5 second converting means for converting a first digital voice signal sampled with the predetermined voice sampling frequency into a second digital voice signal sampled with the predetermined audio sampling frequency;

 first digital processing means for performing a
10 predetermined digital computation on the second digital audio signal sampled with the predetermined voice sampling frequency and a third digital voice signal; and

 second digital processing means for performing the predetermined digital computation on the second digital
15 voice signal sampled with the predetermined audio sampling frequency and the first digital audio signal sampled with the predetermined audio sampling frequency.

19. The semiconductor device according to Claim 18,
20 wherein the predetermined digital computation includes an addition, a subtraction, a rate setting of the addition, and a rate setting of the subtraction.

20. The semiconductor device according to Claim 18,

wherein the first digital processing means performs a volume setting on a digital signal processed with the predetermined digital computation.

5 21. The semiconductor device according to Claim 18,
 wherein the first digital processing means performs a signal
 band limitation on a digital signal processed with the
 predetermined digital computation.

10 22. The semiconductor device according to Claim 21,
 wherein the signal band limitation is pre-programmable.

 23. The semiconductor device according to Claim 18,
 wherein the second digital processing means performs a
15 volume setting on a digital signal processed with the
 predetermined digital computation.

 24. The semiconductor device according to Claim 18,
 wherein the second digital processing means performs a
20 signal band limitation on a digital signal processed with
 the predetermined digital computation.

 25. The semiconductor device according to Claim 21,
 wherein the signal band limitation is pre-programmable.

26. A mobile phone using a semiconductor device, comprising:

input means for converting a voice into an analog
5 voice signal;

analog-to-digital voice converting means for
converting the analog voice signal output from said input
means into a first digital voice signal;

digital-to-analog voice converting means for
10 converting a second digital voice signal sampled with a
predetermined voice sampling frequency for voice signals
into an analog voice signal;

voice output means for generating a voice sound in
accordance with the analog voice signal output from said
15 digital-to-analog voice converting means;

digital-to-analog audio converting means for
converting a digital audio signal sampled with a
predetermined audio sampling frequency for audio signals
into an analog audio signal; and

20 audio output means for generating an audio sound in
accordance with the analog audio signal output from said
digital-to-analog audio converting means,

wherein the semiconductor device is configured to
process the first digital voice signal, the second digital

voice signal sampled with the predetermined voice sampling frequency, and the digital audio signal sampled with the predetermined audio sampling frequency, and comprises:

5 first converting means for converting the digital audio signal into a signal sampled with the predetermined voice sampling frequency;

 second converting means for converting the first digital voice signal into a signal sampled with the predetermined audio sampling frequency;

10 first digital processing means for performing a predetermined digital computation on the digital audio signal sampled with the predetermined voice sampling frequency and the second digital voice signal; and

 second digital processing means for performing
15 the predetermined digital computation on the first digital voice signal sampled with the predetermined audio sampling frequency and the digital audio signal sampled with the predetermined audio sampling frequency.

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27. The mobile phone according to Claim 26, wherein the predetermined digital computation includes an addition, a subtraction, a rate setting of the addition, and a rate setting of the subtraction.

28. The mobile phone according to Claim 26, wherein
the first digital processing means performs a volume setting
on a digital signal processed with the predetermined digital
5 computation.

29. The mobile phone according to Claim 26, wherein
the first digital processing means performs a signal band
limitation on a digital signal processed with the
10 predetermined digital computation.

30. The mobile phone according to Claim 29, wherein
the signal band limitation is pre-programmable.

15 31. The mobile phone according to Claim 26, wherein
the second digital processing means performs a volume
setting on a digital signal processed with the predetermined
digital computation.

20 32. The mobile phone according to Claim 26, wherein
the second digital processing means performs a signal band
limitation on a digital signal processed with the
predetermined digital computation.

33. The mobile phone according to Claim 32, wherein the signal band limitation is pre-programmable.

34. A mobile phone using a semiconductor device,
5 comprising:

input means for converting a voice into an analog voice signal;

analog-to-digital voice converting means for converting the analog voice signal output from said input
10 means into a first digital voice signal;

digital voice amplifying means for amplifying and outputting a second digital voice signal sampled with a predetermined voice sampling frequency for voice signals;

voice output means for generating a voice sound in
15 accordance with the second digital voice signal output from said digital voice amplifying means;

digital audio amplifying means for amplifying and outputting a digital audio signal sampled with a predetermined audio sampling frequency for audio signals;

20 audio output means for generating an audio sound in accordance with the digital audio signal output from said digital audio amplifying means,

wherein the semiconductor device is configured to process the first digital voice signal, the second digital

voice signal sampled with the predetermined voice sampling frequency, and the digital audio signal sampled with the predetermined audio sampling frequency, and comprises:

5 first converting means for converting the digital audio signal into a signal sampled with the predetermined voice sampling frequency;

 second converting means for converting the first digital voice signal into a signal sampled with the predetermined audio sampling frequency;

10 first digital processing means for performing a predetermined digital computation on the digital audio signal sampled with the predetermined voice sampling frequency and the second digital voice signal; and

 second digital processing means for performing
15 the predetermined digital computation on the first digital voice signal sampled with the predetermined audio sampling frequency and the digital audio signal sampled with the predetermined audio sampling frequency.

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35. A method of providing a semiconductor device comprising the steps of:

 first converting a first digital audio signal sampled with a predetermined audio sampling frequency for digital

audio into a second digital audio signal sampled with a predetermined voice sampling frequency for voice signals;

second converting a first digital voice signal sampled with the predetermined voice sampling frequency into a
5 second digital voice signal sampled with the predetermined audio sampling frequency;

first digital processing of the second digital audio signal sampled with the predetermined voice sampling frequency and a third digital voice signal with a
10 predetermined digital computation; and

second digital processing of the second digital voice signal sampled with the predetermined audio sampling frequency and the first digital audio signal sampled with the predetermined audio sampling frequency with the
15 predetermined digital computation.

36. The method according to Claim 35, wherein the predetermined digital computation includes an addition, a subtraction, a rate setting of the addition, and a rate
20 setting of the subtraction.

37. The method according to Claim 35, wherein the first digital processing further comprises the step of setting volume to a digital signal processed with the

predetermined digital computation.

38. The method according to Claim 35, wherein the first digital processing further comprises the step of
5 limiting a signal band of a digital signal processed with the predetermined digital computation.

39. The method according to Claim 38, wherein the limiting step is pre-programmable.

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40. The method according to Claim 35, wherein the second digital processing further comprises the step of setting volume of a digital signal processed with the predetermined digital computation.

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41. The method according to Claim 35, wherein the second digital processing further comprises the step of limiting a signal band of a digital signal processed with the predetermined digital computation.

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42. The method according to Claim 41, wherein the limiting step is pre-programmable.

43. A method of mobile telecommunication using a

semiconductor device, comprising the steps of:

first converting a voice input into a first analog voice signal;

second converting the first analog voice signal output
5 from said converting step into a first digital voice signal;

third converting a second digital voice signal sampled with a predetermined voice sampling frequency for voice signals into a second analog voice signal;

first generating a voice sound in accordance with the
10 second analog voice signal output from said third converting step;

fourth converting a first digital audio signal sampled with a predetermined audio sampling frequency for audio signals into an analog audio signal; and

15 second generating an audio sound in accordance with the analog audio signal output from said fourth converting step,

wherein the semiconductor device is configured to process the first digital voice signal, the second digital
20 voice signal sampled with the predetermined voice sampling frequency, and the first digital audio signal sampled with the predetermined audio sampling frequency, and comprises the steps of:

first converting the first digital audio signal

into a second digital audio signal sampled with the predetermined voice sampling frequency;

second converting the first digital voice signal into a signal sampled with the predetermined audio sampling frequency;

first digital processing of the second digital audio signal sampled with the predetermined voice sampling frequency and the second digital voice signal with a predetermined digital computation; and

second digital processing of the first digital voice signal sampled with the predetermined audio sampling frequency and the first digital audio signal sampled with the predetermined audio sampling frequency with the predetermined digital computation.

44. The method according to Claim 43, wherein the predetermined digital computation includes an addition, a subtraction, a rate setting of the addition, and a rate setting of the subtraction.

45. The method according to Claim 43, wherein the first digital processing step further comprises the step of setting a volume of a digital signal processed with the predetermined digital computation.

46. The method according to Claim 43, wherein the first digital processing further comprises the step of limiting a signal band of a digital signal processed with
5 the predetermined digital computation.

47. The method according to Claim 46, wherein the limiting step is pre-programmable.

10 48. The method according to Claim 43, wherein the second digital processing further comprises the step of setting a volume of a digital signal processed with the predetermined digital computation.

15 49. The method according to Claim 43, wherein the second digital processing further comprises the step of limiting a signal band of a digital signal processed with the predetermined digital computation.

20 50. The method according to Claim 49, wherein the limiting step is pre-programmable.

51. A method of mobile telecommunication using a semiconductor device, comprising the steps of:

first converting a voice input into an analog voice signal;

second converting the analog voice signal output from said converting step into a first digital voice signal;

5 first amplifying to output a second digital voice signal sampled with a predetermined voice sampling frequency for voice signals;

first generating a voice sound in accordance with the second digital voice signal output from said first
10 amplifying step;

second amplifying to output a first digital audio signal sampled with a predetermined audio sampling frequency for audio signals;

second generating an audio sound in accordance with
15 the first digital audio signal output from said second amplifying step,

wherein the semiconductor device is configured to process the first digital voice signal, the second digital voice signal sampled with the predetermined voice sampling
20 frequency, and the first digital audio signal sampled with the predetermined audio sampling frequency, and comprising the steps of:

first converting the first digital audio signal into a second digital audio signal sampled with the

predetermined voice sampling frequency;

second converting the first digital voice signal into a signal sampled with the predetermined audio sampling frequency;

5 first digital processing of the second digital audio signal sampled with the predetermined voice sampling frequency and the second digital voice signal with a predetermined digital computation; and

10 second digital processing of the first digital voice signal sampled with the predetermined audio sampling frequency and the first digital audio signal sampled with the predetermined audio sampling frequency with the predetermined digital computation.